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Nishimura

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(54) **HYDRAULIC EXCAVATOR**

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E02F 9/08 (2006.01)

(52) **U.S. Cl.**
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USPC **180/89.1**; 180/68.1; 37/347; 37/379; 37/381; 37/443

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USPC 180/89.13, 68.1, 312; 37/347, 379, 381, 37/443
See application file for complete search history.

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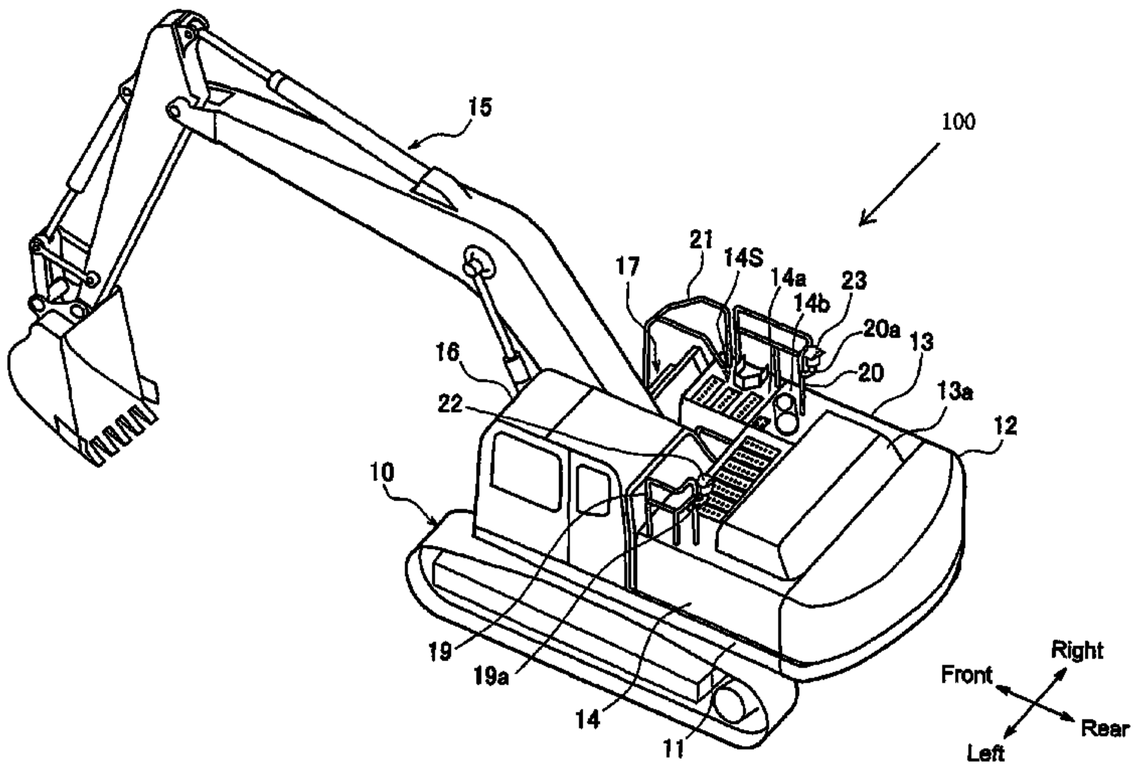
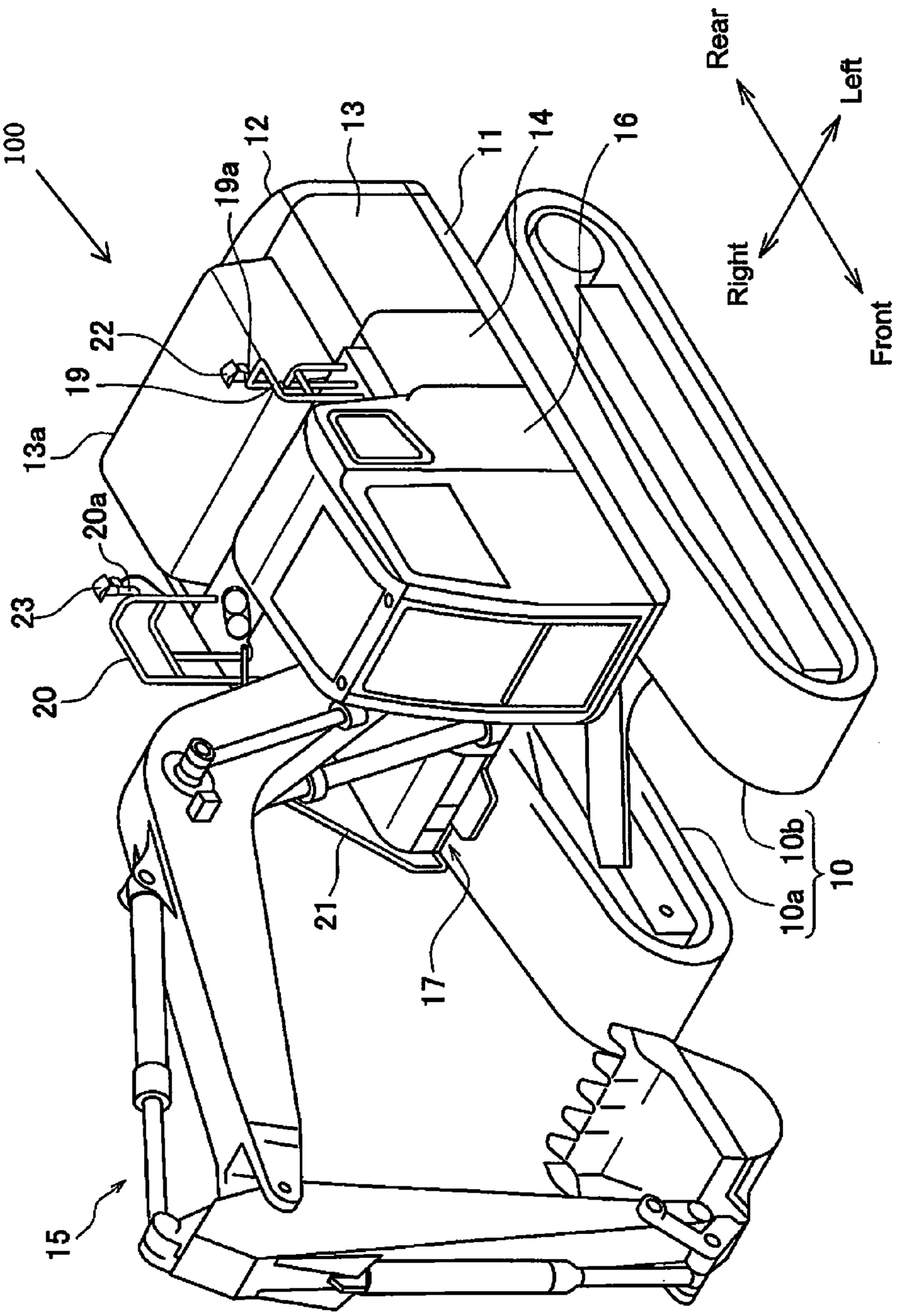
(57) **ABSTRACT**

A hydraulic excavator basically includes a lower traveling unit, an upper revolving unit, a counterweight, a machine compartment, a first handrail, a second handrail and a pair of antenna supporting parts. The upper revolving unit is revolvably mounted on the lower traveling unit. The counterweight is disposed on the upper revolving unit. The machine compartment is disposed in front of the counterweight on the upper revolving unit. The first and second handrails are disposed on the machine compartment. The antenna supporting parts are configured to support a pair of antennas. The antenna supporting parts are respectively connected to the first and second handrails.

17 Claims, 5 Drawing Sheets

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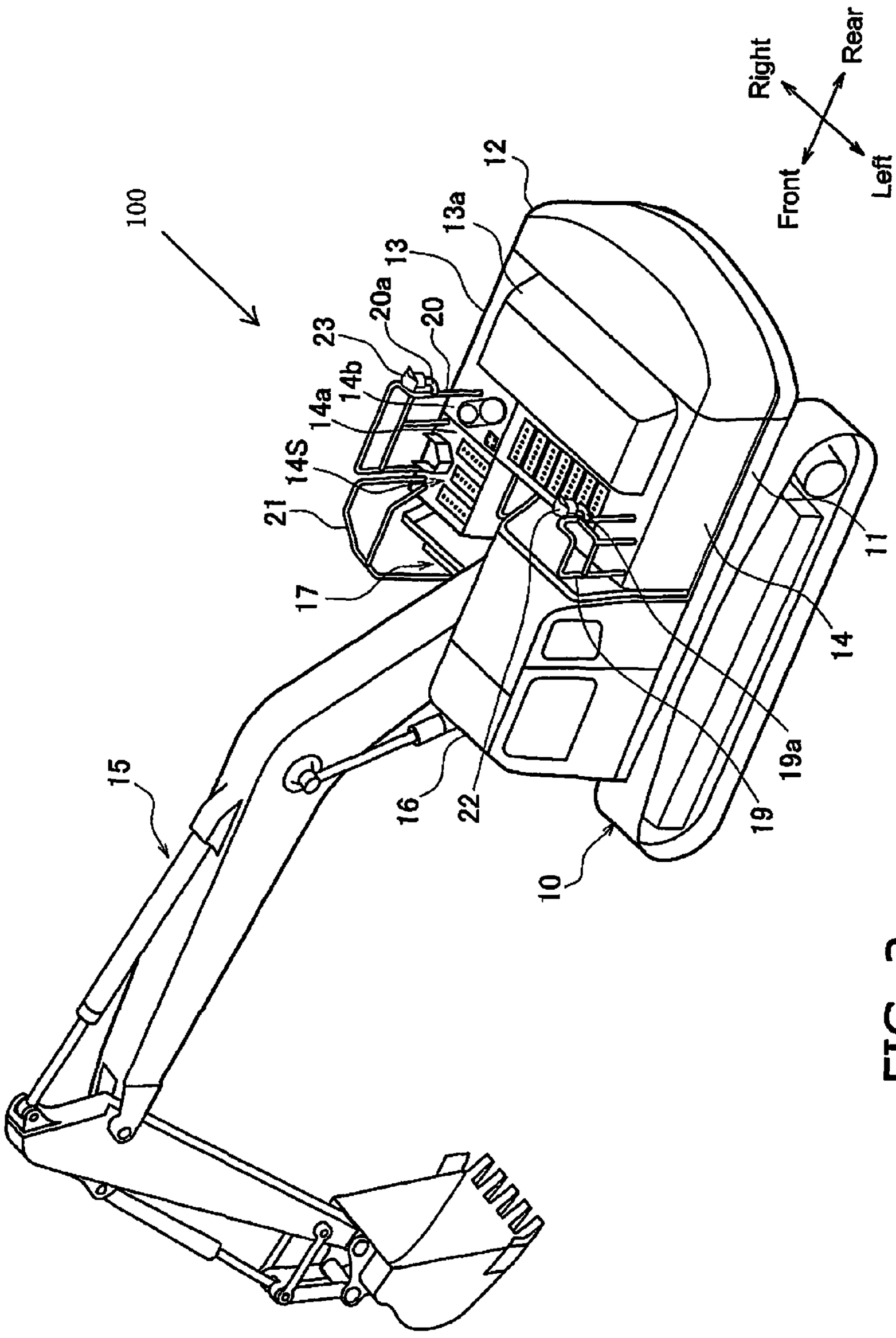
12
13
11
14
16
19a
19
22
13a
20a
23
20
21
17
10a
10b
10
15
Rear
Left
Right
Front

FIG. 1


Right
Rear
Front
Left
100
12
13a
13
20a
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14b
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14S
21
17
15
16
22
10
19
19a
14
11

FIG. 2

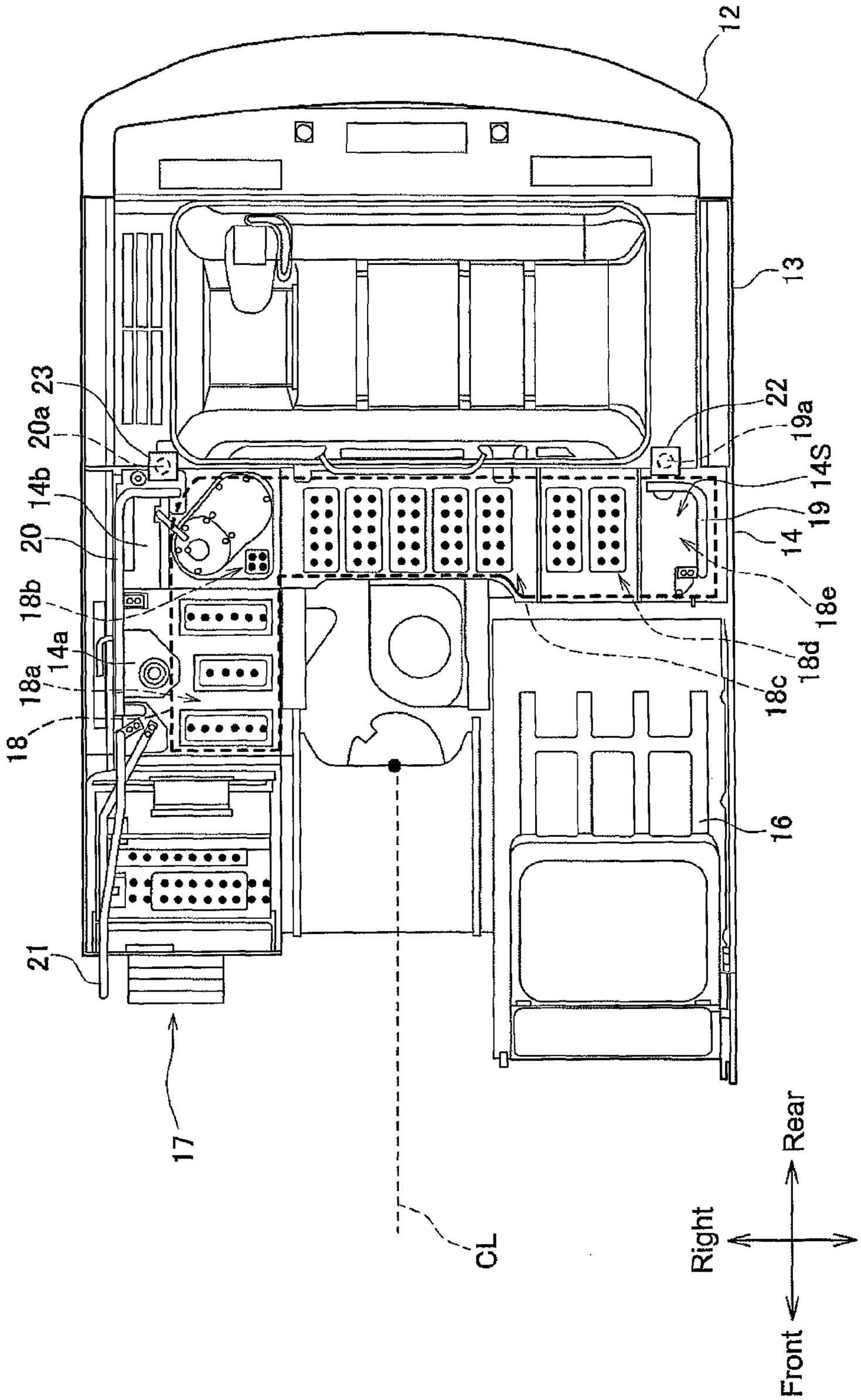
12
13
23
20a
14b
20
18b
14a
18a
18
22
19a
14S
19
14
18e
18d
18c
16
21
17
CL
Rear
Right
Left
Front

FIG. 3

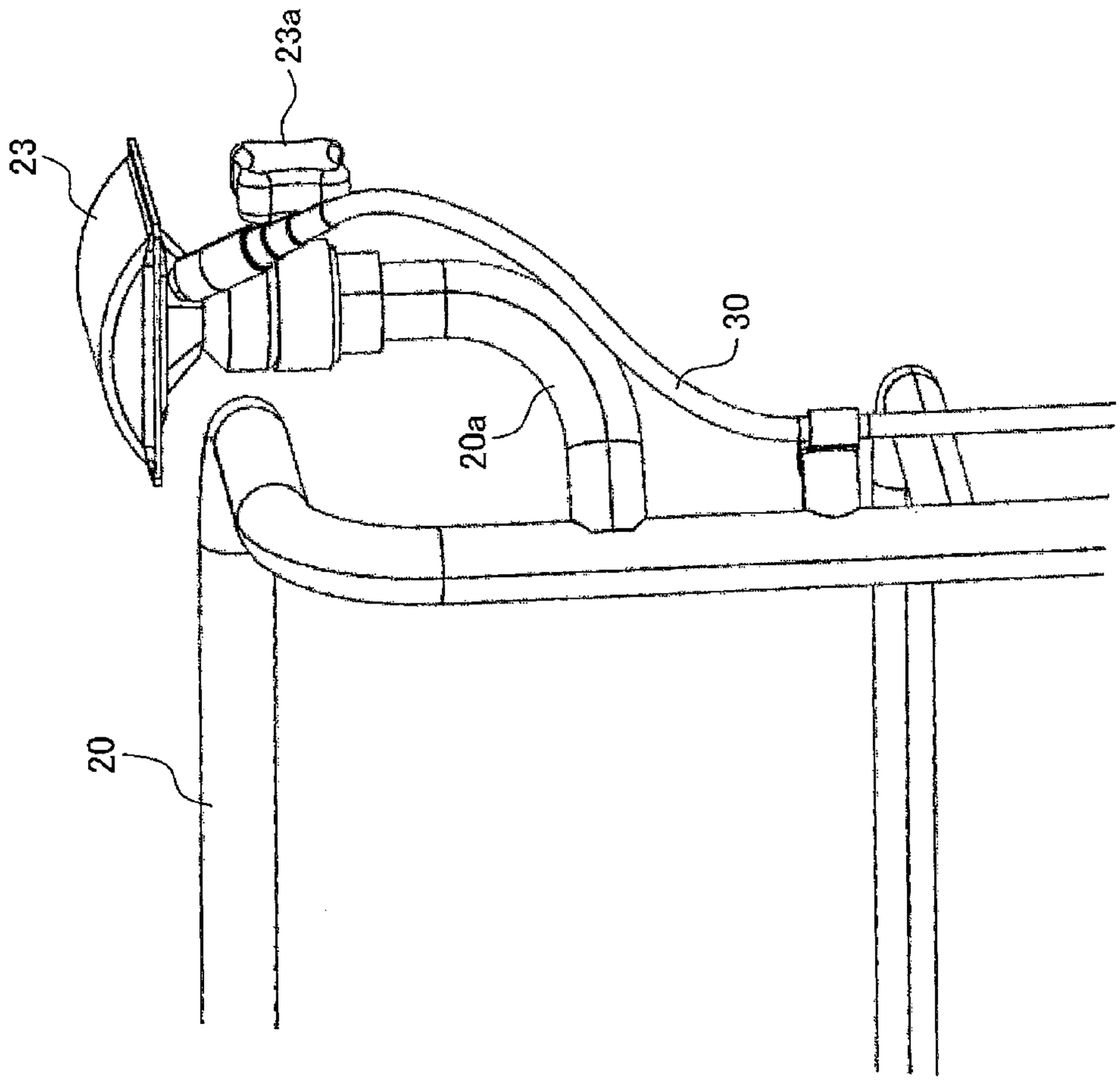

FIG. 4

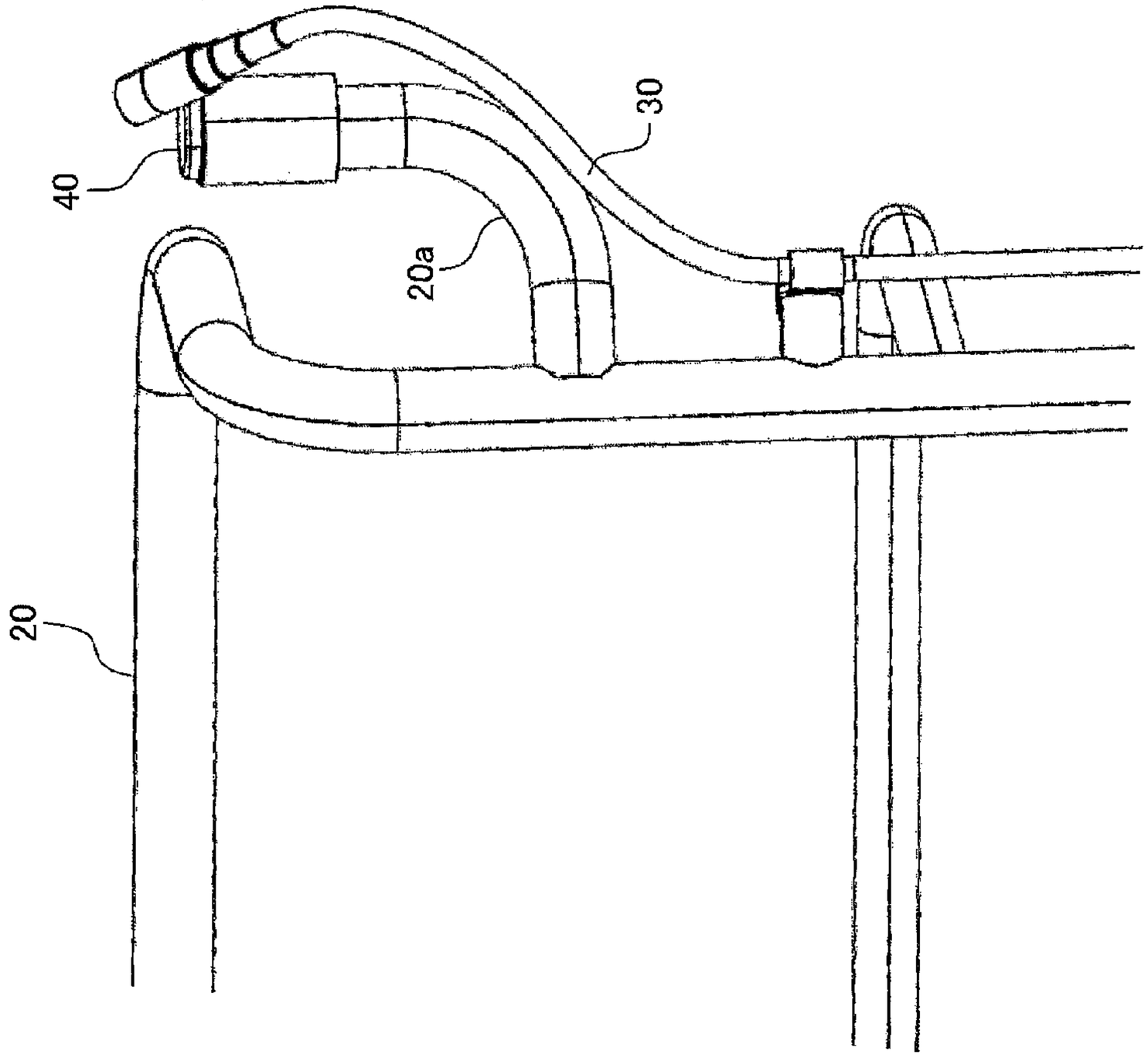

FIG. 5

HYDRAULIC EXCAVATOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a U.S. National stage application of International Application No. PCT/JP2012/079381, filed Nov. 13, 2012.

BACKGROUND

1. Field of the Invention

The present invention relates to a hydraulic excavator that can be equipped with a GNSS antenna.

2. Background Information

A hydraulic excavator equipped with an antenna for a Real Time Kinematic-Global Navigation Satellite System (RTK-GNSS) is known in the prior art (e.g., see Japanese Patent Laid-open No. 2008-102097). The antenna is installed on a counterweight.

SUMMARY

However, when the antenna is placed on the counterweight, the workability for attaching and removing the antenna is low because the operator is required to conduct work on top of the counterweight when attaching or removing the antenna.

An object of the present invention is to provide a hydraulic excavator that allows for improved workability when attaching and removing an antenna.

A hydraulic excavator according to a first embodiment of the present invention comprises a lower traveling unit, an upper revolving unit, a counterweight, a machine compartment, a passage, and a pair of antenna supporting parts for supporting a pair of antennas. The upper revolving unit is rotatably mounted on the lower traveling unit. The counterweight is disposed on the upper revolving unit. The machine compartment is disposed in front of the counterweight on the upper revolving unit. The passage is formed on the machine compartment. The pair of antenna supporting parts is disposed above the passage. The pair of antenna supporting parts is positioned near the outer edge of the passage when viewed from above.

According to the hydraulic excavator according to the first embodiment of the present invention, since the operator is able to conduct work to attach and remove the pair of antennas, the workability of attaching and removing the pair of antennas can be improved.

The hydraulic excavator according to a second embodiment of the present invention is related to the first embodiment, and includes a pair of handrails disposed on the machine compartment along the outer edge of the passage. The pair of antenna supporting parts is connected to the pair of handrails.

According to the hydraulic excavator according to the second embodiment of the present invention, there is no need to provide a separate member for supporting the pair of antenna supporting parts.

The hydraulic excavator according to a third embodiment of the present invention is related to the first embodiment, and further comprises a pair of handrails disposed on the machine compartment. The pair of antenna supporting parts is a portion of the pair of handrails.

According to the hydraulic excavator according to the third embodiment of the present invention, there is no need to provide a separate member for supporting the pair of antenna supporting parts.

The hydraulic excavator according to a fourth embodiment of the present invention is related to the second embodiment, wherein the pair of handrails is disposed on the left and right relative to a center line in the front-rear direction.

According to the hydraulic excavator according to the fourth embodiment of the present invention, positional coordinates of the hydraulic excavator can be calculated with high precision on the basis of position information of the pair of antennas since the pair of antennas is disposed away from each other to the right and left relative to the center line.

A hydraulic excavator according to a fifth embodiment of the present invention is related to the second to fourth embodiments, and the pair of antenna supporting parts is positioned on a side opposite to the passage relative to the pair of handrails when viewed from above.

According to the hydraulic excavator according to the fifth embodiment of the present invention, an operator can recognize that the pair of antenna supporting parts is not a handrail. Therefore, there is no need to improve the strength of the pair of antenna supporting parts as much as the handrails.

The hydraulic excavator according to a sixth embodiment of the present invention is related to the first to fifth embodiments, and further comprises a pair of antennas removably attached to the pair of antenna supporting parts.

According to the hydraulic excavator according to the sixth embodiment of the present invention, the operator can easily attach or detach the pair of antennas at the start or completion of work.

A hydraulic excavator according to a seventh embodiment of the present invention is related to the first to sixth embodiments, and the machine compartment includes an engine compartment disposed in front of the counterweight, and an equipment compartment disposed in front of the engine compartment The passage is formed on the equipment compartment.

According to the hydraulic excavator according to the seventh embodiment of the present invention, in comparison to a case in which the passage is formed on the engine compartment, the pair of antennas can be disposed closer to the revolving center of the upper revolving unit As a result, the positional coordinates of the hydraulic excavator can be calculated with high precision on the basis of position information of the pair of antennas.

According to the present invention, a hydraulic excavator can be provided that allows for improved workability when attaching and removing the antenna.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a frontal perspective view of a hydraulic excavator.

FIG. **2** is a rear perspective view of the hydraulic excavator.

FIG. **3** is a top view of an equipment compartment.

FIG. **4** illustrates a configuration of the pair of antenna supporting parts.

FIG. **5** illustrates a configuration of the pair of antenna supporting parts.

DETAILED DESCRIPTION OF EMBODIMENTS

Next, an embodiment of the present invention will be explained with reference to the drawings. In the following description of the drawings, identical or similar parts are given identical or similar reference numerals. However, the drawings are schematic and dimensional ratios and the like may differ from the actual objects. Therefore, detailed dimensions and the like should be determined in consideration of

the following drawings. Moreover, it is needless to say that parts with mutually different dimensional relationships or ratios are included in mutual relationships in the drawings.

In the following description, "up," "down," "front," "rear," "left," and "right" are terms used on the basis of an operator sitting in an operator's seat.

A configuration of a hydraulic excavator **100** according to an embodiment shall be explained in detail with reference to the drawings. FIG. **1** is a front perspective view of the hydraulic excavator **100**. FIG. **2** is a rear perspective view of the hydraulic excavator **100**.

The hydraulic excavator **100** includes a lower traveling unit **10**, an upper revolving unit **11**, a counterweight **12**, an engine compartment **13**, an equipment compartment **14**, work implement **15**, a cab **16**, a steps **17**, a first handrail **19**, a second handrail **20**, a third handrail **21**, a first GNSS antenna **22**, and a second GNSS antenna **23**.

The lower traveling unit **10** includes a pair of rotatable crawlers **10***a*, **10***b* that operate independently of each other. The hydraulic excavator **100** moves back and forth and left and right by rotating the pair of crawlers **10***a*, **10***b*.

The upper revolving unit **11** is mounted in a rotatable manner on the lower traveling unit **10**. The upper revolving unit **11** constitutes the vehicle body frame of the hydraulic excavator **100**. The counterweight **12**, the equipment compartment **14**, the engine compartment **13**, and the cab **16** are disposed on the upper revolving unit **11**

The counterweight **12** is disposed on the rearmost side of the upper revolving unit **11**. The counterweight **12** is formed by inserting waste steel or concrete into a box assembled from steel plates. The counterweight **12** is used to maintain balance while doing excavation work and the like.

The engine compartment **13** is disposed on the upper revolving unit **11**. The engine compartment **13** is disposed in front of the counterweight **12**. The engine compartment **13** is disposed behind the equipment compartment **14**. The engine compartment **13** accommodates an engine and an exhaust gas treatment device and the like that are not illustrated in the drawings. An engine hood **13** that can be opened and closed is disposed above the engine compartment **13**. The operator can stand on a passage **18** and open the engine hood **13** when conducting maintenance inside the engine compartment **13**.

The equipment compartment **14** is disposed between the engine compartment **13** and the work implement **15** on the upper revolving unit **11**. The equipment compartment **14** includes a fuel tank **14***a* and an operating fluid tank **14***b*. In the present embodiment, an upper surface **14**S of the equipment compartment **14** is formed in an L shape as illustrated in FIG. **2**.

In the present embodiment, the engine compartment **13** and the equipment compartment **14** constitute a machine compartment upon which the passage **18** is formed.

The work implement **15** is mounted in a swingable manner at the front side of the upper revolving unit **11**. The work implement **15** is disposed in front of the equipment compartment **14**. The work implement **15** is supported by the upper revolving unit **11** between the cab **16** and the steps **17**.

The cab **16** is disposed on the upper revolving unit **11**. The cab **16** is provided in front of the equipment compartment **14** and to the left of the work implement **15** to allow the operator to view the movement of the work implement **15**. An operator's seat in which the operator sits is provided inside the cab **16**.

The steps **17** is disposed at the front right of the equipment compartment **14**. The steps **17** are used for climbing up and down between the ground and the passage **18**.

The passage **18** is formed on the equipment compartment **14**. The passage **18** is a substantially flat area of the upper surface **14**S of the equipment compartment **14**. In other words, the passage **18** is an area where the operator can place his feet of the upper surface **14**S of the equipment compartment **14**. The passage **18** according to the present embodiment is formed in an L shape in accordance with the shape of the upper surface **14**S of the equipment compartment **14**. The configuration of the passage **18** is described below.

The first and second handrails **19**, **20** are disposed on the equipment compartment **14**. The first and second handrails **19**, **20** are provided at the edges of the passage **18** and are used by the operator standing on the passage **18** to support his body. The first handrail **19** and the second handrail **20** are separated from each other in the left-right direction. Thus, the operator standing between the first handrail **19** and the second handrail **20** is able to open the engine hood **13***a* to conduct maintenance inside the engine compartment **13**. The first handrail **19** is disposed on the left end of the equipment compartment **14**. The second handrail **20** is disposed on the right end of the equipment compartment **14**. The second handrail **20** is disposed on the fuel tank **14***a* and the operating fluid tank **14***b*.

In the present embodiment, both the first and second handrails **19**, **20** take the form of an L shape when viewed from above. Specifically, one side of the L shape extends in the front-back direction along the both side edges of the upper revolving unit **11**, and the other side of the L shape extends from the rear end of the one side toward the inside of the upper revolving unit **11**.

A first antenna supporting part **19***a* is connected to the first handrail **19**. The first antenna supporting part **19***a* is a bracket for attaching the first GNSS antenna **22**. Similarly, a second antenna supporting part **20***a* is connected to the second handrail **20**. The second antenna supporting part **20***a* is a bracket for attaching the second GNSS antenna **23**. Disposition and configuration of the first and second antenna supporting parts **19***a*, **20***a* are explained below.

The third handrail **21** is disposed in front of the first handrail **19** and to the right of the steps **17**. The third handrail **21** is used by the operator to support his body while ascending and descending the steps **17**.

The first and second GNSS antennas **22**, **23** are antennas used for a Real Time Kinematic-Global Navigation Satellite System (RTK-GNSS). The first and second GNSS antennas **22**, **23** are disposed above the passage **18**. "Above the passage **18**" is a concept that includes, in addition to the space vertically above the passage **18**, a surrounding space near the space vertically above the passage **18**. The first GNSS antenna **22** is attached to the first antenna supporting part **19***b* of the first handrail **19**. The second GNSS antenna **23** is attached to the second antenna supporting part **20***b* of the second handrail **20**.

Next, the disposition of the first and second antenna supporting parts **19***a*, **20***a* is described with reference to the drawing. FIG. **3** is a top view of the equipment compartment **14**.

First, the configuration of the passage **18** will be described with reference to FIG. **3**.

The passage **18** includes a first passage section **18***a*, a second passage section **18***b*, a third passage section **18***c*, a fourth passage section **18***d*, and a fifth passage section **18***e*.

The first passage section **18***a* is formed to the rear of the steps **17**. The first passage section **18***a* is formed on the upper surface of the fuel tank **14***a* on the upper surface **14**S. The second passage section **18***b* is formed to the rear of the first passage section **18***a*. The second passage section **18***b* is

formed on the upper surface of the operating fluid tank **14***b* on the upper surface **14**S. The third passage section **18***c* is formed to the left of the second passage section **18***b*. The fourth passage section **18***d* is formed to the left of the third passage section **18***c*. The fifth passage section **18***e* is formed to the left of the fourth passage section **18***d*. In this way, the first and second passage sections **18***a*, **18***b* extend in the front-back direction, and the second to fifth passage sections **18***b* to **18***e* are aligned in a row in the left-right direction. Therefore, the entire passage **18** forms an L shape.

A non-slip treatment is applied to the surface of the first to fourth passage sections **18***a* to **18***d*. Specifically, a plurality of half-spherical protrusions is formed on the surface of the first to fourth passage sections **18***a* to **18***d*. In the present embodiment, the non-slip treatment is not applied to the fifth passage section **18***e*, but the non-slip treatment may also be applied to the fifth passage section **18***e*.

Next, the configuration of first and second handrails **19**, **20** is described with reference to FIG. **3**.

The first handrail **19** is disposed along the outer edge of the first and second passage sections **18***a*, **18***b*. The second handrail **20** is disposed along the outer edge of the fifth passage section **18***e*. The first and second handrails **19**, **20** are disposed away from each other relative to a center line CL in the front-rear direction of the hydraulic excavator **100**, as shown in FIG. **3**.

Next, the installation positions of the first and second antenna supporting parts **19***a*, **20***a* are described with reference to FIG. **3**.

The first and second antenna supporting parts **19***a*, **20***a* are positioned near the outer edge of the passage **18** when viewed from above. Specifically, the first antenna supporting part **19***a* is adjacent to the fifth passage section **18***e* of the passage **18**. The second antenna supporting part **20***a* is adjacent to the second passage section **18***b* of the passage **18**.

The first and second antenna supporting parts **19***a*, **20***a* are respectively positioned to the rear of the first and second handrails **19**, **20**. Therefore, the first and second antenna supporting parts **19***a*, **20***a* are positioned to the rear of the passage **18**.

The first and second antenna supporting parts **19***a*, **20***a* are disposed away from each other relative to the center line CL in the front-rear direction, as shown in FIG. **3**. The first and second antenna supporting parts **19***a*, **20***a* according to the present embodiment are positioned symmetrically on the right and left relative to the center line CL.

The first and second antenna supporting parts **19***a*, **20***a* are positioned on a boundary line between the engine compartment **13** and the equipment compartment **14**. However, the first and second GNSS antennas **22**, **23** only need to be positioned near the outer edge of the passage **18**, the first and second GNSS antennas **22**, **23** may be positioned above the engine compartment **13** or the equipment compartment **14** in the vertical direction.

Since the first and second GNSS antennas **22**, **23** are respectively attached to the first and second antenna supporting parts **19***a*, **20***a*, the disposition of the first and second GNSS antennas **22**, **23** are the same as the disposition of the abovementioned first and second antenna supporting parts **19***a*, **20***a*.

Next, the configuration of the first and second antenna supporting parts **19***a*, **20***a* is explained with reference to the drawings. The following is an explanation of the configuration of the second antenna supporting part **20***a* since the first and second antenna supporting parts **19***a*, **20***a* have the same configuration.

FIG. **4** illustrates a condition in which the second GNSS antenna **23** is attached to the second antenna supporting part **20***a*. FIG. **5** illustrates a condition in which the second GNSS antenna **23** is removed from the second antenna supporting part **20***a*.

The second antenna supporting part **20***a* is a bracket configured by a circular tube bent into an L shape. The second antenna supporting part **20***a* extends backward and upward from the rear part of the second handrail **20**. The second antenna supporting part **20***a* is disposed on the side opposite to the passage **18** with the second handrail **20** interposed therebetween since the passage **18** is in front of the rear part of the second handrail **20**. Since the first and second GNSS antennas **22**, **23** are to the outside of the passage with the handrail interposed therebetween due to this disposition, unexpected contact with the first and second GNSS antennas **22**, **23** due to someone moving along the passage can be avoided. The height of the second antenna supporting part **20***a* is preferably similar to that of the second handrail **20**.

As illustrated in FIG. **4**, the second GNSS antenna **23** is disposed on the second antenna supporting part **20***a*. The second GNSS antenna **23** is preferably disposed in a position higher than the second handrail **20** in order to properly receive GNSS satellite radio waves. The second GNSS antenna **23** has a knob **23***a* for connecting the second GNSS antenna **23** to the second antenna supporting part **20***a*. A cable **30** for transmitting position information to a controller is connected to the second GNSS antenna **23**.

The second GNSS antenna **23** is preferably disposed in a position higher than the upper surface of the cab **16** in order to properly receive GNSS satellite radio waves.

As illustrated in FIG. **5**, a cap **40** is fitted onto the second antenna supporting part **20***a* when the second GNSS antenna **23** is removed.

The first and second antenna supporting parts **19***a*, **20***a* (example of a pair of antenna supporting parts) in the present embodiment are positioned near the outer edge of the passage **18** when viewed from above.

Therefore, since the operator is able to conduct the work of attaching and removing the first and second GNSS antennas **22**, **23** while standing on the passage **18**, the workability for attaching and removing the first and second GNSS antennas **22**, **23** is improved.

(2) The first and second antenna supporting parts **19***a*, **20***a* are respectively connected to the first and second handrails **19**, **20**.

Therefore, there is no need to provide separate members to support the first and second antenna supporting parts **19***a*, **20***a*.

(3) The first and second antenna supporting parts **19***a*, **20***a* are disposed on the right and left relative to the center line CL in the front-rear direction.

Therefore, the first and second GNSS antennas **22**, **23** are disposed away from each other on the left and right relative to the center line CL. As a result, the positional coordinates of the hydraulic excavator **100** can be calculated with high precision on the basis of the position information of the first and second GNSS antennas **22**, **23**.

(4) The first and second antenna supporting parts **19***a*, **20***a* are positioned on the side opposite to the passage **18** relative to the first and second handrails **19**, **20**.

Therefore, the operator can recognize that the first and second antenna supporting parts **19***a*, **20***a* are not handrails. Thus, there is no need to improve the strength of the first and second antenna supporting parts **19***a*, **20***a* as much as the handrails.

(5) The first and second GNSS antennas **22**, **23** (example of a pair of antennas) are removably attached to the first and second antenna supporting parts **19***a*, **20***a*.

Therefore, the operator is able to easily attach or remove the first and second GNSS antennas **22**, **23** when starting or finishing work.

(6) The passage **18** is formed on the equipment compartment **14**.

Therefore, the first and second GNSS antennas **22**, **23** can be positioned closer to the revolving center of the upper revolving unit **11** than a case in which the passage is formed on the engine compartment **13**. As a result, the positional coordinates of the hydraulic excavator can be calculated with high precision on the basis of position information of the first and second GNSS antennas **22**, **23**.

Other embodiments

While the present invention has been described with the embodiment provided above, the description and drawings form a portion of the disclosure and are not to be understood as limiting the invention. Various substitutions, embodiments, and operation techniques will be apparent to those skilled in the art.

While the passage **18** is formed on the equipment compartment **14** in the above embodiment, the present invention is not limited as such. The passage **18** may be formed on a "machine compartment" disposed on the upper revolving unit **11**. Therefore, the passage **18** may be formed on the engine compartment **13**, or may be formed on both the engine compartment **13** and the equipment compartment **14**. Thus, the passage **18** is not required to take the form of an L shape, and is able to take the form of various shapes.

(B) While the "machine compartment" is described as being constituted by the engine compartment **13** and the equipment compartment **14** in the above embodiment, the present invention is not limited as such. The "machine compartment" may be a structure disposed in front of the counterweight **12** and structures other than the engine compartment **13** and the equipment compartment **14** may be included therein.

(C) While the first and second antenna supporting parts **19***a*, **20***a* are connected respectively to the pair of handrails **19**, **20** in the above embodiment, the present invention is not limited as such. The first and second antenna supporting parts **19***a*, **20***a* may be connected directly to the equipment compartment **14** and the like.

(D) While the first and second antenna supporting parts **19***a*, **20***a* are positioned respectively to the rear of the first and second handrails **19**, **20** in the above embodiment, the present invention is not limited as such. The first and second antenna supporting parts **19***a*, **20***a* may be respectively positioned in front of or to the side the first and second handrails **19**, **20**.

(E) While not discussed in particular on the above embodiment, the first and second antenna supporting parts **19***a*, **20***a* may overlap the outer edge of the passage **18** or may not overlap the outer edge of the passage **18** when viewed from above. "Near the outer edge of the passage **18**" in the present description does not imply overlapping the outer edge of the passage **18**.

(F) While the first and second antenna supporting parts **19***a*, **20***a* are described as being configured separately from the first and second handrails **19**, **20** in the above embodiment, the first and second antenna supporting parts **19***a*, **20***a* may respectively be a portion of the first and second handrails **19**, **20**.

As described above, it is a matter of course that the present invention incorporates a variety of preferred embodiments which are not described herein. Hence the technical scope of the present invention is defined only by matters to define the invention, which are according to the scope of claims, reasonable from the above description.

The present invention is useful in the field of hydraulic excavators since the work to attach and remove antennas can be improved according to the hydraulic excavator of the present invention.

What is claimed is:

1. A hydraulic excavator comprising:
a lower traveling unit;
an upper revolving unit revolvably mounted on the lower traveling unit;
a counterweight disposed on the upper revolving unit;
a machine compartment disposed in front of the counterweight on the upper revolving unit;
a passage extending left and right over a center line extending in the front-rear direction of the hydraulic excavator on the machine compartment; and
first and second of antenna supporting parts disposed above the passage and configured to support first and second of antennas, the pair of antenna supporting parts being positioned near an outer edge of the passage as viewed from above,
the first and second antenna supporting parts being disposed on the left and right relative to the center line.

2. The hydraulic excavator according to claim **1**, further comprising:
first and second of handrails disposed on the machine compartment along the outer edge of the passage, the first and second antenna supporting parts being connected to the first and second handrails, respectively.

3. The hydraulic excavator according to claim **2**, wherein
the first and second handrails are disposed on the left and right relative to a center line in a front-rear direction of the hydraulic excavator.

4. The hydraulic excavator according to claim **3**, wherein
the first and second antenna supporting parts are positioned on a side opposite to the passage relative to the first and second handrails as viewed from above.

5. The hydraulic excavator according to claim **3**, further comprising:
first and second antennas removably attached to the first and second antenna supporting parts, respectively.

6. The hydraulic excavator according to claim **3**, wherein
the machine compartment includes an engine compartment disposed in front of the counterweight, and an equipment compartment disposed in front of the engine compartment; and
the passage is formed on the equipment compartment.

7. The hydraulic excavator according to claim **2**, wherein
the first and second supporting parts are positioned on a side opposite to the passage relative to the first and second handrails as viewed from above.

8. The hydraulic excavator according to claim **7**, further comprising:
first and second antennas removably attached to the first and second antenna supporting parts, respectively.

9. The hydraulic excavator according to claim **7**, wherein
the machine compartment includes an engine compartment disposed in front of the counterweight, and an equipment compartment disposed in front of the engine compartment; and
the passage is formed on the equipment compartment.

10. The hydraulic excavator according to claim 2, further comprising:

first and second antennas removably attached to the first and second antenna supporting parts, respectively.

11. The hydraulic excavator according to claims 2, wherein

the machine compartment includes an engine compartment disposed in front of the counterweight, and an equipment compartment disposed in front of the engine compartment; and

the passage is formed on the equipment compartment.

12. The hydraulic excavator according to claim 1, further comprising:

first and second of handrails disposed on the machine compartment, the first and second antenna supporting parts being a portion of the first and second handrails, respectively.

13. The hydraulic excavator according to claim 12, further comprising:

first and second antennas removably attached to the first and second antenna supporting parts, respectively.

14. The hydraulic excavator according to claim 12, wherein

the machine compartment includes an engine compartment disposed in front of the counterweight, and an equipment compartment disposed in front of the engine compartment; and

the passage is formed on the equipment compartment.

15. The hydraulic excavator according to claim 1, further comprising:

first and second antennas removably attached to the first and second antenna supporting parts, respectively.

16. The hydraulic excavator according to claim 15, wherein

the machine compartment includes an engine compartment disposed in front of the counterweight, and an equipment compartment disposed in front of the engine compartment; and

the passage is formed on the equipment compartment.

17. The hydraulic excavator according to claim 1, wherein

the machine compartment includes an engine compartment disposed in front of the counterweight, and an equipment compartment disposed in front of the engine compartment; and

the passage is formed on the equipment compartment.

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